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ABSTRACT

Self-report ergometric inventories can provide valuable information to employers and can serve as a means of intervention to improve employee attributes. Based on the science of ergonomics (a science that studies the natural laws of work in order to maximize human efficiency in job performance), such an inventory focuses on the interaction of the individual with the workplace. Thus, an effective ergonomics inventory must comprise questions concerning employees' personal characteristics as well as the tasks, tools, and work space of their jobs. (This paper consists of a 51-item sample ergonomics self-report inventory, a discussion of the pros and cons of administering self-report inventories, an analysis of factors affecting job performance, and a brief description of the procedures for designing such an inventory.) (MN)

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DESIGNING AND IMPLEMENTING AN ERGONOMICS INVENTORY TO IMPROVE MANAGEMENT OF HUMAN FACTORS PROGRAMS

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The subject of human factors in organizational design and management is multidimensional and requires collecting and interpreting information from a variety of sources in order to maximize human efficiency. This paper analyzes the self report inventory in a dual role of providing valuable information to employers and as an intervention to improve employee attributes. Factors that affect performance are identified and translated into questionnaire items. A specific inventory is then constructed and a brief discussion of administration is included.

INTRODUCTION

Ergonomics is a science which studies the natural laws of work in order to maximize human efficiency in job performance. Areas of focus include people, the work they do, the things they work with, and the environment of the workplace. Through analysis of the interaction between areas of focus, people can be selected and trained to fit some jobs while other jobs can be modified to fit the people who are available to work. The information necessary to facilitate this analytical process can be acquired from a variety of sources including statistical statements, direct observation, and from the people themselves. One method of gathering information from people is called the self report inventory. Self report inventories seek to obtain precise and dependable information by placing the individual in a standardized situation to which he/she must respond.

Cronbach (1960) describes the various advantages and disadvantages involved in use of the self report inventory. Since each employee has had many opportunities to observe himself/herself in a variety of situations, a valuable report of typical behavior can be given. Not only can past experiences and unobservable aspects of a subjects life be shared, but far more incidents can be included than an observer could record and some of the difficulties of field

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observation can be avoided. However, if the self report is to be representative of typical behavior, responses to the questionnaire must be accurate and honest. Unfortunately, people tend to present a public self concept that is socially acceptable rather than one that is totally accurate. Even when the individual attempts to be truthful, one cannot assume that he/she is a completely accurate, detached and impartial observer. Other disadvantages involved in the use of self report inventories are that the items can be ambiguous, that subjects might interpret questions differently due to individual self concept or situational experiences, that individual response styles (Lorge, 1937) and interpretation of adverbs used for answers vary from subject to (Simpson, 1944), and that the intent of the tester may vary from the intent of the subject (Edwards, 1957).

Distortion in self report can be overcome to a certain extent, although it cannot be eliminated completely. The test and testing situation can be designed in such a way as to promote an atmosphere of cooperation rather than one of evaluation. The terms "questionnaire" or "inventory" should be used instead of "test". If the questionnaire is administered by an independent consultant, subjects can be assured that the results will not be self incriminating. The consultant could make a detailed report to the employer recommending improvements. Concordantly, during the testing session every attempt must be made to establish rapport by creating a friendly and relaxed atmosphere. Subjects will be more receptive and willing to participate if they can understand that the results will be used to help them perform their duties more efficiently, and, in fact, could actually make their job easier. It is also preferable to design test items in such a way so that possible responses range on a numeric continuum (seven point scale) between extremes rather than by merely using ambiguous adverbs (i.e., sometimes or often, like or dislike, etc.). In addition, the self report inventory sheet should be free of possibly incriminating details (name, age, etc.) since the top page could be seen by unqualified bystanders or other employees. If the front cover includes only the name and basic concept of the inventory, then all personal and specific information can be contained between the covers to insure confidentiality.

When using a self report inventory, one must realize that the information obtained is merely a statement of the subject's public self concept. Ambiguity of test items and inevitable distortion in self observation reduce the correspondence between responses and actual behavior. Therefore, information obtained from a self report inventory can only be considered as one part of a complex whole and not as an entity in itself. However, in terms of an intervention designed to improve employee attributes, valuable information can be passed on to the subjects provided that at the end of the inventory there is a section detailing implications of questionnaire items. This section can be given to the subjects for later reference.

The entire process would also be facilitated by a review session following test administration where all items and related issues could be discussed. The appropriateness of test items in relation to factors that affect performance is a critical issue involved in determining the effectiveness of the inventory.

FACTORS THAT AFFECT PERFORMANCE

The interraction between job factors contributes to employee health, safety, wellbeing and productivity. For any specific situation, the employee, the tools, the task or job content, and the work station and environment each have specific factors which can be identified and translated into questionnaire items. If employees can gain significant understanding regarding the interraction between factors, then quality of experience and quantity of performance can be improved.

No two individuals are exactly alike and no two actions are performed in exactly the same manner. Consequently, when analyzing the relationship between employee attributes and performance of a task one must consider similarities and differences within specific areas. For the purposes of this paper, discussion of employee attributes will be limited to the areas of 1) physical characteristics, 2) attitudes and beliefs, and 3) skills and behavior.

Physical charactristics include structural (standing and sitting height, etc.) and dynamic dimensions (sideways and forward reach, etc.), sensory ability (sight, hearing, touch, smell and taste), age, sex, physical strength, posture, and whether one is right-handed, left handed or ambidextrous to name a few. The workspace design should be based on body dimensions. Since people vary greatly from the "average dimensions", the workplace needs to be adjustable. Questions concerning physical characteristics can provide information that can be used to evaluate work stations, and such items can increase employee awareness of the relationship between physical characteristics and workplace design (i.e., seating, physical dimensions of workspace, design of controls and displays, etc.).

Some of the implications of physical characteristics can be realized by analyzing statistics from the U.S. Department of Labor. Length of service and age affect the rate of injury reported in workman's compensation claims. Individuals who have been employed one year or less have twice the probability of being injured on the job as people with longer tenure. Employees between the age of 25 and 34 years of age also have a greater incidence of reported injury on the job (followed by those under 25 years, then gradually decreasing rates for individuals over 35 years old). The most frequently reported types of injuries involve situations where workers were struck by something, followed by overexertion and being struck against something. Highest reported nature of injury or

illness involves sprains and strains (25%), cuts, lacerations and punctures (24%), and various other sources (i.e., contusions, scratches, burns, fractures and multiple injuries). These statistics support the creation and implementation of safety education programs. However, no program is effective unless the workers have suportive attitudes, beliefs and skills.

According to Barry Schlenker (1980) the impression people create is affected by attitudes and beliefs. Attitudes describe an individual's feelings about self or the world, and beliefs describe one's thoughts. Since birth, we have accumulated attitudes and beliefs (through social interaction) about who we are, what we can and can't do, what's right and wrong, etc. These feelings and thoughts can be self supportive or destructive, appropriate or inappropriate, and may require behavior change in order to improve performance. Techniques of behavior self modification involve: selecting a problem behavior then analyzing the antecedent (set of conditions occuring before), the behavior itself and the consequences of that behavior (Watson and Tharp, 1981). In the work environment, attitudes and beliefs affect performance. By analyzing one's thoughts and feelings toward self, job duties, tools and the workplace environment (including other people) the antecedents of performance can be discovered. One's ability to control thoughts and feelings can be viewed as a skill that can be developed (similar to job skills that improve with information, motivation and practice).

Personal characteristics, as well as various dimensions of the task, tools and workplace all affect the extent of human efficiency. Information from various sources can be compared with the results of the self report inventory in order to gain an accurate and realistic perspective.

DESIGNING THE INVENTORY

Questionnaire items have been selected in two general areas: Part I includes personal characteristics and Part II includes tasks, tools and workspace. An asterisk at the end of an item indicates that there is a footnote for that statement on the last page. By reviewing the rootnotes individually as well as in the group session following administration of the questionnaire, subjects can gain a better understanding of ergonomic principles. Evaluation of the results would involve reviewing subject responses in comparison to work conditions, available training, and future performance. Because the major focus of this discussion involves construction of an ergonomics inventory, designed primarily for its value as an intervention rather than as an evaluation tool, the remainder of this paper will be devoted to the actual inventory.

INSTRUCTION PAGE

Date of Employment_____

Name_____ Height_____ Weight_____ Sex____

Ethnicity_____ Date of Birth_____ Married: Yes__ No__

Right Handed__ Left Handed__ Ambidextrous__ Job Title_____

Name and Age of Dependent Children_____

Disability that Affects Work (Describe)_____

_____

_____

In this inventory, you will find questions about you and your job. This information will help you gain a better understanding of the interaction between personal characteristics, job content, tools and the work station environment. Please read carefully and answer every item as accurately as possible.

Start with the two simple examples below, for practice. As you see, each inquiry is actually put in the form of a sentence. Indicate how each statement applies to you by circling one of the numbers on the seven point scale located on the right side of the page. MARK NOW.

	Rarely						Always
1. I enjoy my job	1	2	3	4	5	6	7
2. I have enough energy to do what I want	1	2	3	4	5	6	7

Now: 1. Make sure you have filled in all the blanks at the top.
2. Answer all items. Your responses will be entirely confidential.

Most people finish in five minutes, some in ten. After completing all items, take a few minutes to review the FOOTNOTES on the last page.

TURN THE PAGE AND BEGIN

PART I - PERSONAL CHARACTERISTICS	Rarely						Always
1. I feel tired or rundown (except after strenuous work)*	1	2	3	4	5	6	7
2. I can talk to family or friends about important matters	1	2	3	4	5	6	7
3. I experience aches and pains during or after work	1	2	3	4	5	6	7
4. I enjoy my work	1	2	3	4	5	6	7
5. I can say "no" without guilt	1	2	3	4	5	6	7
6. My supervisor listens to my comments and suggestions*	1	2	3	4	5	6	7
7. I meditate or center myself for 15-30 mins. at least once a day*	1	2	3	4	5	6	7
8. I use a shoulder/lap seat belt while riding in a motor vehicle*	1	2	3	4	5	6	7
9. I smoke cigarettes	1	2	3	4	5	6	7
10. I do a vigorous type of exercise (like swimming, brisk walking, etc.) for 15-30 mins. at least 3 times a wk*	1	2	3	4	5	6	7
11. I do stretching exercises (like yoga or calisthenics) that enhance my muscle tone for 15-30 mins. at least 3 times a wk*	1	2	3	4	5	6	7
12. I eat a balanced diet every day (protein, legumes, seeds & nuts, whole grains, fresh fruits & vegetables)*	1	2	3	4	5	6	7
13. I don't deny my feelings of anger, joy, fear or sadness*	1	2	3	4	5	6	7
14. I have an avocational activity outside of work that I enjoy	1	2	3	4	5	6	7
15. I keep informed of local, national and world news	1	2	3	4	5	6	7
16. I enjoy spending some time without planned or structured activities*	1	2	3	4	5	6	7
17. I look forward to being at least 75*	1	2	3	4	5	6	7
18. I limit the amount of salt, sugar and animal fat that I eat*	1	2	3	4	5	6	7
19. I limit the amount of alcohol and caffeine that I drink	1	2	3	4	5	6	7
20. I have less than 4 colds or other minor illness per year	1	2	3	4	5	6	7
21. I have a good appetite and maintain a weight within 15% of my ideal weight	1	2	3	4	5	6	7
22. My job is stressful	1	2	3	4	5	6	7
23. Men and women are better off when employed in jobs suitable for their social role*	1	2	3	4	5	6	7
24. I am able to "turn off" thoughts that make me feel bad*	1	2	3	4	5	6	7
25. I am able to relax whenever I want*	1	2	3	4	5	6	7

PART II - TASKS, TOOLS AND WORKSPACE	Rarely						Always
1. Every day, I stand still in one place at work*	1	2	3	4	5	6	7
2. Throughout the day, I sit down to work*	1	2	3	4	5	6	7
3. On the job, I'm required to lift or move heavy objects*	1	2	3	4	5	6	7
4. My job duties are repetitive*	1	2	3	4	5	6	7
5. I'm required to keep pace with electronic or mechanical devices*	1	2	3	4	5	6	7
6. My job requires lots of responsibility and little recognition*	1	2	3	4	5	6	7
7. I get along well with people at work	1	2	3	4	5	6	7
8. I use tools with short handles that press into the palm of my hand*	1	2	3	4	5	6	7
9. I use tools that weigh more than 30 pounds*	1	2	3	4	5	6	7
10. The controls I use are easy to reach and within my normal field of vision*	1	2	3	4	5	6	7
11. I receive adequate training to do the work required of me	1	2	3	4	5	6	7
12. I'm able to maintain a normal, comfortable body temperature at work	1	2	3	4	5	6	7
13. The lighting at work is good (not too bright, or too dim, no glare, etc.)	1	2	3	4	5	6	7
14. It is too noisy to concentrate at work (sharp, loud, or continuous)	1	2	3	4	5	6	7
15. I am informed of all potential hazards, and provided with necessary information/equipment to reduce them	1	2	3	4	5	6	7
16. I smell gaseous fumes at work	1	2	3	4	5	6	7
17. I have been injured on the job	1	2	3	4	5	6	7
18. I fit comfortably in my workspace	1	2	3	4	5	6	7
19. The visual displays that I work with are easy to see without straining	1	2	3	4	5	6	7
20. The seating is adjustable*	1	2	3	4	5	6	7
21. I am required to hold a posture for long periods of time*	1	2	3	4	5	6	7
22. My job requires me to do a lot of reaching (above, below, sideways or behind)	1	2	3	4	5	6	7
23. The tools I use are balanced and easy to hold in one hand (if not mounted)	1	2	3	4	5	6	7
24. I use tools that weigh between 5-30 pounds*	1	2	3	4	5	6	7
25. I understand exactly what is required of me at work, and how that fits into the entire operation of the company*	1	2	3	4	5	6	7
26. I feel that no matter how well I perform, I could always do better*	1	2	3	4	5	6	7

FOOTNOTES

PART I - PERSONAL CHARACTERISTICS

1. Fatigue without apparent cause is not a normal condition and usually indicates illness, stress or denial of emotional expression.(Travis)
6. Intrinsic factors such as challenge and considerate, thoughtful employers affect job satisfaction. (Work in America)
7. Meditation or centering greatly enhances well-being. (Naranjo, Ornstein, McCamy, Pearce, Abrams & Siegel, Bloomfield & Kory, Vattano, Benson)
8. Shoulder/lap belts are much safer than lap belts alone.
10. Vigorous aerobic exercise that keeps the heart rate at 150 beats per minute for 15-30 minutes produces enormous physical and psychological benefits. (Bloomfield and Kory)
11. Such exercise produce a greater sense of well-being while preventing stiffness of joints and musculo-skeletal degeneration. (Mishra)
12. A daily balanced diet provides the necessary vitamins and minerals necessary to maintain health and energy. (Bloomfield and Kory)
13. Repressing emotions can cause disease, anxiety, depression and irrational behavior which interferes with performance. (Travis)
16. Spending some time without structured activities can be self-renewing. (Travis)
17. With proper care, most can reach this age in good health.
18. Salt added while cooking draws many vitamins out of the food and it is also harmful to the kidneys and contributes to high blood pressure. Sugar provides only "empty" calories and contributes to arteriosclerosis. Consumption of animal fat increases cholesterol in the system. (Kirschmann)
24. Social role stereotyping can limit an individual's choices regarding employment decisions and can be a source of stress. (Brislin, Schlenker, Goleman, Argyris, Carter and Patterson)
25. Overall performance can be improved through acquisition of self controlled behavior change techniques. (Watson and Tharp)
26. Systematic relaxation techniques have enormous physical and psychological benefits. (Selye, Jacobson)

PART II - TASKS, TOOLS AND WORKSPACE

1,2,20,21. Holding a posture for an extended period of time can cause aches and pains. The workspace should be adjustable with armrests, foot pads, etc., to reduce physical strain. (Morris, Burdick, Webb Singleton, IAPA)

3,9,24,25. Care should be used whenever one is required to do prolonged or heavy lifting. Twisting can cause strain, as can lifting from an unbalanced posture. Expectations or stereotypic reactions can be deceiving (i.e., very large objects or dark objects imply heaviness; heavy objects are expected to be at the bottom, etc.). (Woodson)

25. Employees who understand their job and the way their work fits into the company as a whole are generally more effective, less stressed and more successful. (Drucker, Ordione, Ouchi, Tarrant)

26. Type "A" personalities who continuously pressure themselves to achieve greater goals have higher rates of heart attack. However, Type "A" personalities who exercise regularly and see themselves as being in control have a lower rate of heart disease. (Bloomfield and Kory)

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